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UNIVERSITY OF LONDON
INSTITUTE OF ARCHAEOLOGY

GEOCHRONOLOGICAL TABLE No. 2

THE AGE OF NEANDERTHAL MAN

WITH NOTES ON

THE COTTE DE ST. BRELADE

JERSEY, C.I.

BY

FREDERICK E. ZEUNER
(Lecturer in Geochronology and Palaeoclimatology at the Institute)

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EDITORIAL NOTE

The *Geochronological Tables* are intended to provide chronological information in tabular form, with a text as concentrated as possible and chiefly supplying the sources from which the tables in question are derived. As a rule, the series is not supposed to include original papers, but to supply the results of recent chronological work in an easily surveyable form, especially for the purpose of instruction. It is not restricted to any particular period.

Numbers in preparation will deal with the Post-glacial chronology (Neolithic and Bronze Age), the chronology of the Irish Stone Age, the human finds and industries of Java, etc.

F. E. ZEUNER

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THE AGE OF NEANDERTHAL MAN, WITH NOTES ON THE COTTE DE ST. BRELADE JERSEY, C.I.

By FREDERICK E. ZEUNER

THE following is a brief survey of localities at which fossil remains of man of the Neanderthal race have been found. A somewhat fuller account is included of the Cotte de St. Brelade, Jersey, Channel Islands, which the author had occasion to study in 1938 on the invitation of the Société Jersiaise.

This survey represents the answer to an enquiry which Professor W. Le Gros Clark of Oxford kindly submitted, asking to what extent the known remains of *Homo neanderthalensis* can be arranged in a chronological order.

The method of dating adopted is geological or, more precisely, palaeo-climatological, only the evidence afforded by the composition of the strata and by the fauna and flora contained having been used. Archaeological evidence in the form of implements found either associated with the skeletal remains or in the strata above or below has not been considered in the actual fixing of the date unless expressly stated. It has, however, often provided a welcome opportunity of checking the results. There is reason to believe that the higher Levalloisian and the Mousterian industries were those of *Homo neanderthalensis*, whilst the Upper Palaeolithic (Aurignacian, etc.) has everywhere been found associated with *Homo sapiens*. It is possible, therefore, that the distribution in time and space of these industries reproduces the distribution of the two types of man. To convey an impression of the distribution of the industries Table 3 has been included in this paper.

Generally speaking no remains of Neanderthal man have so far been found older than the last interglacial (Riss/Würm), with the possible exception of the Steinheim skull which might date from the interstadial Riss I/II. The skull recently found at Swanscombe on the Lower Thames dates from the interglacial Mindel/Riss and therefore is older than any of the remains discussed here. Yet it is not neanderthaloid, but allied to *Homo sapiens* (Clark, in *Journal R. Anthrop. Inst.*, **68**, pp. 17-98, London, 1938).

Within the interglacial Riss/Würm, the majority of Neanderthal finds are likely to date from the second part, i.e. after the short and weak cool phase called Pre-Würm.

Most of the remains of Neanderthal man so far found belong to the first phase of the last glaciation (Würm). This glaciation has been subdivided into three phases (I, II, III) separated by two milder interstadials. *Homo neanderthalensis* has not yet been found in any deposit which, on geological grounds, must be referred to the second or third phase of Würm. Archaeology largely supports the view that at least in Europe he was the type of man of Würm I, but it must not be overlooked that

local survival into Würm II of the Levalloisian industry (and therefore possibly of *H. neanderthalensis*) has been suggested for France and Italy (compare Table 3). *Homo neanderthalensis* therefore might have survived into a time when *Homo sapiens* had already occupied a large portion of Europe and the Mediterranean.

In the following report, the localities are arranged chronologically as far as this is possible and, within the same climatic phase, the most reliable cases are given first. The reliability and degree of precision of dating are indicated in the text. References have been restricted to one or two publications which afford chronological evidence, and contain further references. Much additional information may be gathered from A. Keith's *Antiquity of Man* and his *New Discoveries relating to the Antiquity of Man*, from Boule's *Fossil Man*, and from Obermaier's *Fossil Man in Spain*. Table 1 summarises the results and compares them in part with Obermaier's chronological arrangement which, however, is based entirely on the associated industries.

A. Remains possibly earlier than Interglacial Riss/Würm.

Steinheim

This important skull was discovered and prepared by F. Berckhemer. It occurred in a gravel of the river Neckar some distance from Stuttgart at a depth of 7 m. below the surface; 1·5-2 m. of Younger Loess covered the gravel which is divided into an upper part with a cold fauna characterised by the mammoth, and a lower complex characterised by *Elephas antiquus* and many other interglacial species. The human skull came from the *antiquus*-gravel and cannot therefore be later than the interglacial Riss/Würm. It may be contemporary with Taubach and Ehringsdorf, but Berckhemer is inclined to consider the alternative of an even earlier age, namely that of an interstadial of the Riss glaciation. He quotes the views of several mammalian palaeontologists who are not prepared to admit an age later than the Riss glaciation.

The alternative therefore remains of regarding the Steinheim skull as dating from the interstadial Riss I/Riss II, or even the Great Interglacial, or else from the last interglacial (Riss/Würm). The precise age has still to be determined, but the skull is certainly at least as old as the finds from Krapina, Taubach and Ehringsdorf, if not considerably older.

Berckhemer, F.: Ein Menschenschädel aus den diluvialen Schottern von Steinheim a.d. Murr.—*Anthrop. Anzeiger*, **10** (4), pp. 318-321, Stuttgart, 1933.
——: Der Steinheimer Urmensch und die Tierwelt seines Lebensgebietes.—*Aus der Heimat*, **47**, Stuttgart, 1934.
Weinert, H.: Der Urmenschenschädel von Steinheim.—*Zeitschr. Morphol. Anthrop.*, **35**, pp. 463-517, 6 pls., Stuttgart, 1936.

B. Interglacial Riss/Würm

Rome, or Saccopastore

The two skulls were found, in 1929 and 1935 respectively, one almost exactly above the other, in the disused gravel pit of Saccopastore near Rome. The gravel forms a

low terrace of the river Aniene which flows into the Tiber. A. C. Blanc attributes this terrace to the Tyrrhenian transgression during which the rivers had to adjust their beds to a sea-level higher than the present. It is towards the end of this phase of aggradation that Neanderthal man must have lived in the Aniene valley. The Tyrrhenian transgression being contemporary with the Riss/Würm interglacial, the skulls appear to date from the later part of this period.

The few stone implements found at Saccopastore cannot be identified typologically. The fauna, particularly the mollusca, indicates a somewhat dry and cool phase. It is possible that this was the cool oscillation Pre-Würm, during which the terrace was formed on which the deposits of Taubach and Ehringsdorf rest.

BREUIL, H., and BLANC, A. C.: Le nouveau crâne néanderthalien de Saccopastore (Rome).—*Anthrop.*, **46**, pp. 1-16, Paris, 1936.

EHRINGSDORF, NEAR WEIMAR

The remains of *H. neanderthalensis* were found in the Lower Travertine of the valley of the Ilm. This deposit of calcareous springs rests on an aggradation terrace of the river, which was dated by Soergel as representing the cool oscillation Pre-Würm of the Interglacial Riss/Würm. The Lower Travertine contains a temperate forest flora and fauna with several decidedly warm elements. Mousterian implements were found also. It is covered by a loess, an Upper Travertine, and an upper loess, representing the two younger loesses of Würm I and Würm II, separated by a milder phase evidenced by the Upper Travertine. Thus, the human remains antedate the last glaciation but postdate the cool oscillation Pre-Würm; in other words, they belong to the latter half of the last interglacial.

SOERGEL, W.: Exkursion ins Travertingebiet von Ehringsdorf.—*Palaeont. Zeitschr.*, **8**, pp. 7-33, pl. 1, Berlin, 1926.

TAUBACH NEAR WEIMAR

The travertine in which human remains were found at Taubach near Weimar is the same as the Lower Travertine of the neighbouring locality Ehringsdorf. It rests on the same Pre-Würm terrace and, therefore, also dates from the second half of the interglacial Riss/Würm.

SOERGEL, W.: 1926. (See Ehringsdorf.)

KRAPINA

At this famous locality there was, in Neanderthal times, a cave or shelter carved out of Miocene sandstone. Most of the filling is composed of weathering-debris of this sandstone, with intercalated cultural layers. The basal strata, however, are fluviatile, consisting of gravel, sand, and floodloam. Human occupation began during this phase though it did not become permanent until the river had ceased flooding

the cave from time to time. The floor of the cave is 25 m. above the present river. Stratigraphy does not afford a clue to the precise geological age of the locality. The fauna, however, is highly characteristic and, as Gorjanović-Kramberger and M. Schlosser emphasise, similar to that of Taubach-Ehringsdorf. It is a warm, interglacial, fauna, with *Rhinoceros merckii* as chief representative. The deposit, including the human remains, thus appears to belong to the last interglacial and to be almost contemporary with Taubach and Ehringsdorf.

Obermaier has given certain important details which are worth mentioning in this connection. The marmot, the only alpine element of the fauna, was *not* found *in situ*, and was confined to the upper layers. The cave bear was present throughout the section, but was really abundant in the uppermost layers. Though *Ursus spelaeus* is is certainly not characteristic of a cold climate it seems to have been more frequent during the cold phases. The top of the section, therefore, might indicate a recrudescence of climate which, if the main deposit was formed during the interglacial Riss/Würm, would have been connected with the glacial phase Würm I.

The industry is typically Mousterian, according to Obermaier.

OBERMAIER, H.: La station paléolithique de Krapina.—*Anthrop.*, **16,** pp. 13-27, Paris, 1905.
GORJANOVIĆ-KRAMBERGER, K.: Der diluviale Mensch von Krapina in Kroatien.—*Studien über die Entwicklungsmechanik des Primatenskelettes.* (Ed. by O. Walkhoff.), **2,** pp. 59-277, 14 pls., Wiesbaden, 1906.

MOUNT CARMEL

The neanderthaloid skeletons found in the caves of Mount Carmel, Palestine, were all associated with implements classified by Garrod as Levalloiso-Mousterian. The skeletons from the Tabun cave were contemporaneous with a Lower Levalloiso-Mousterian and, according to Bate, with a mammalian fauna indicating a fairly dry and warm climate with permanent rivers (horizon Tabun C). This horizon was covered by one with Upper Levalloiso-Mousterian and a very different fauna of a damper climate (Tabun B); it also yielded skeletal remains of neanderthaloid man. A further dry oscillation is testified by the succeeding stratum in which the Upper Palaeolithic begins; it is followed by a final damp phase (Middle Aurignacian; neanthropic man found at this level in the Wad cave). After this, the climate became increasingly drier and present-day conditions were approached.

Another cave, the Mugharet es-Skhul, contained a Lower Levalloiso-Mousterian horizon from which a large number of neanderthaloid skeletons were recovered. Typologically it is contemporary with Tabun C, but Bate regards the fauna as slightly later than that of Tabun C, although it is certainly earlier than Tabun B.

The two wet phases which followed the dry and warm phase of the occupation of Tabun C and of Skhul appear to represent the two maxima of the last Mediterranean pluvial which is equivalent to the last glaciation of temperate Europe. The faunal change as well as the change in the human industries strongly support this interpretation, according to which the human remains date from the latter part of the last inter-

pluvial which was approximately contemporary with the last interglacial of temperate Europe, and from the first phase of the last pluvial.

GARROD, D. A. E., and BATE, D. M. A.: *The Stone Age of Mount Carmel*, I, 240 pp., 55 pls., Oxford, 1937.
ZEUNER, F. E.: Die Gliederung des Pleistozäns und des Paläolithikums in Palästina.—*Geol. Rundschau*, **29**, pp. 514-517, Stuttgart, 1938.
MCCOWN, T. D., and KEITH, SIR ARTHUR: *The Stone Age of Mount Carmel*, II, 390 pp., 28 pls., Oxford, 1939.

GALILEE

The skull was found by Turville-Petre in the Mugharet-el-Zuttiyeh, near Lake Tiberias, Palestine, resting at the bottom of a Mousterian layer of 0·9 m. thickness. This layer was sealed by almost a pavement of rock debris. Above it, only Bronze Age and later deposits followed. The section, therefore, gives no indication of the geological age of the skull. The fauna might suggest a warm phase with steppe dominating, remains of gazelle being much more frequent than those of deer. On palaeontological grounds, the Galilee skull need not differ in age from the reliably dated finds of Mount Carmel.

The accompanying Mousterian industry also shows that the age of this skull cannot differ widely from that of Mount Carmel man. Though with a question mark, Miss Garrod has correlated it with the Lower Levalloiso-Mousterian of the Mount Carmel Caves.

TURVILLE-PETRE, F.: *Researches in Prehistoric Galilee*, 119 pp., 30 pls., London, 1927. (British School of Archaeology, Jerusalem.)
BATE, D. M. A.: *In Turville-Petre*, 1927.
GARROD, D. A. E., and BATE, D. M. A.: 1937. (See Mount Carmel.)

C. WÜRM I

MONTE CIRCEO, OR GROTTA GUATTARI.

This excellently preserved skull, discovered by A. C. Blanc only a year ago, rested on the surface of the deposits in an entirely sealed cave, the Grotta Guattari at San Felice Circeo, about 55 miles south-east of Rome. Excavations have only just begun, but preliminary reports are available. The accompanying fauna indicates a climate of the woodland type. Cold elements are absent, unless one counts the ibex as such. A Mousterian industry was found at the entrance, covered by the talus which blocked the cave.

Blanc is inclined to think that, as in the numerous other sea caves of the Monte Circeo, the cultural stratum rests on the beach deposits of the Tyrrhenian transgression. The skull therefore is likely to be later than the climax of this transgression and

thus either very late interglacial Riss/Würm, or even of Würm I age. Blanc emphasises that it appears to be later than the skulls from Saccopastore.

BLANC, A. C.: L'Uomo fossile del Monte Circeo: Un cranio neandertaliano nella Grotta Guattari a San Felice Circeo.—*R.C.R. Accad. Naz. Lincei, Cl. Sci. fis.*, (6) **29** (5), pp. 205-210, 1 pl., Roma, 1939.

SPY

The two skeletons of Spy near Namur, Belgium, rested on a terrace in front of a cave, separated from the bedrock by a weathering soil formed during a period of temperate climate. They were covered by a layer of stony "yellow clay," presumably of a loessic type, containing an upper Mousterian industry and numerous bones of woolly rhinoceros, horse, mammoth, hyena and other species. These conditions suggest that the skeletons were laid down in the early part of the cold phase Würm I, when the deposition of the Younger Loess I began. They cannot be much older than the beginning of the loess phase since, without a rapidly formed cover, they would have been destroyed by weathering. Moreover, they rested *on* a weathered surface indicating a temperate climate and probably belonging to the preceding (last) interglacial.

The upper part of the section confirms this determination. The Mousterian horizon (?loessic) is covered by a layer with an Aurignacian industry; it is of a reddish colour which might be interpreted as due to weathering, but the contained fauna is cold. This level, in turn, is covered by an upper Aurignacian horizon (with Font-Robert points), described as a yellow clayey tufa. This, perhaps, represents the second Younger Loess, corresponding to Würm II or an early part of this phase. The top of the section is formed by debris of rock which is appropriately considered as the product of a phase of intense frost-weathering (Würm II).

This interpretation of the Spy section is entirely based on literature, but it appears to agree well with evidence for the Mousterian occupation of the Rhine valley. In addition, it would indicate that Aurignacian man immigrated during the latter half of Würm I, provided the interpretation of the reddish layer is correct.

DE PUYDT, M., and LOHEST, M.: L'Homme contemporain du Mammouth à Spy.—*Congr. archéol.* Namur, 1887.

RUTOT, A.: Coup d'Oeil synthétique sur l'époque des cavernes.—*Bull. Soc. Belg. Géol.*, **23** (3), pp. 225-292, 1 pl., Bruxelles, 1910.

LA-CHAPELLE-AUX-SAINTS

The skeleton was found embedded in an artificial ditch underneath a Mousterian occupation layer. It was accompanied by implements and the leg of a large bovid. The occupational stratum went right across the grave, indicating that man was in the cave after the burial. This stratum contains numerous Mousterian implements and a cold fauna with woolly rhinoceros, reindeer and marmot. It is therefore to be considered of glacial age. The grave with the skeleton is regarded as belonging to this

layer and thus should also date from Würm I to which the cold Mousterian has been assigned elsewhere. Bouyssonie and Bardon were of the opinion that some of the remains contained in the covering layer were offerings to the dead. According to its position, however, the skeleton might be slightly earlier than the cultural stratum.

Boule, M.: L'Homme fossile de La Chapelle-aux-Saints.—*Ann. Paléont.*, **6**, pp. 111-172, pls. 17-20, Paris, 1911; **7**, pp. 18-56, pl. 4, and pp. 85-192, pls. 6-19., Paris, 1912; **8**, pp. 1-72, Paris, 1913.

La Quina

The female skeleton found by H. Martin at La Quina, Charente, came from a fluviatile layer containing a Middle Mousterian industry and a reindeer-fauna. The overlying stratum which contained a highly evolved Mousterian, yielded a child's skull and part of a lower jaw. The fauna of this bed is the same as that of the Middle Mousterian, and the same applies to the Lower Mousterian layer from which no human bones are known. Martin emphasises that the cold fauna occurs throughout the section and that there is no evidence of a warm Mousterian. Neither the basal nor the covering strata afford a means of dating the sequence purely geologically, but the fauna suggests that it was formed during the cold phase Würm I. Archaeology and geological superposition suggest that the child is slightly later than the woman.

Martin, H.: Un crâne d'enfant néanderthalien du gisement de La Quina.—*Anthrop.*, **31**, p. 331, Paris, 1921.
——: L'Homme fossile de La Quina.—*Arch. Morphol. générale expériment.*, **15**, pp. 260, Paris, 1923.

La Naulette

The lower jaw, found by E. Dupont in 1866, came from a cave called Trou de Naulette, in the valley of the Lesse, not far from Namur. It lay in a stratum 4·5 m. below surface level, and was associated with Mousterian implements and with remains of mammoth, reindeer and other mammals.

The section consists of about 3 m. of yellowish sand or clayey sand which, from the description, appears to be the equivalent of a loess blown by wind into the cave and deposited there under at least seasonally damp conditions. This deposit rests on a series of stalagmitic floors alternating with clay, measuring about 1·5 m., and doubtless formed under decidedly moist conditions. This complex rests on about 6 m. of a material which is loessic and similar to the top stratum. It contained the Naulette jaw, together with reindeer, chamois, horse, mammoth, marmot, etc. At the bottom of the succession an "argile rouge" was found.

This section reproduces the numerous open-air sections of North France and West Germany, showing the surface of the Rissian loess weathered during the last interglacial (argile rouge) covered by the two Younger Loesses corresponding to

Würm I and II. If the correlation of Naulette with these sections is correct, the Naulette jaw would date from the maximum of the first phase of the Würm glaciation.

DUPONT, E.: Étude sur les fouilles scientifiques dans les cavernes de la Lesse.—*Bull. Acad. R. Belgique*, (2) **22**, pp. 31–54, pls. 1–2, Bruxelles, 1866.

LA FERRASSIE

Skeletons of two adults and three children were found at the base of a Mousterian layer which rested on an Acheulian one. It was covered by an Aurignacian sequence. The fauna consisted of bison, deer, horse, and reindeer, the latter being rare. In the Aurignacian horizons it became more frequent. This distinction is characteristic of the cold phases Würm I and Würm II, and it is therefore probable that the Mousterian with its Neanderthal men dates from Würm I. The Mousterian is early according to the original publications, but Obermaier considers it as middle.

CAPITAN and PEYRONY: Deux squelettes humains au milieu de foyers de l'époque moustérienne.—*Bull. Mém. Soc. anthrop. Paris*, (6) **1**, pp. 48-53, pls. 1-2, Paris, 1910.
BOULE, M.: *Fossil Men*, 504 pp., London, 1923. (See p. 190.)

PECH DE L'AZÉ

In a small cave at Pech de l'Azé, five kilometres from Sarlat, Dordogne, Peyrony found the skull of a child, aged 5 to 6 years, in an upper Mousterian layer covered by 3 m. of talus. The fauna included reindeer. One can therefore assume that the skull dates from the cold phase Würm I.

CAPITAN and PEYRONY: 1910. (See La Ferrassie.)

JERSEY

The large cave called Cotte de St. Brelade, in Jersey, Channel Islands, has become known for the discovery of thirteen isolated teeth of Neanderthal man. A rich Levalloisian and Mousterian industry, and a varied fauna of mammals has also been found in this cave. The credit for the discovery of *Homo neanderthalensis* and for carrying on the excavations even under difficult conditions goes to Dr. R. R. Marett, who, for almost thirty years has spent much of his energy on this work.

The cave lies in a small promontory which faces west and is cut off from the mainland by a deep fissure running north-south. In the middle, the fissure is met at right angles by a second, called the ravine, which points west and slopes steeply down to the sea. The northern half of the north-south fissure forms the cave, this being the only part with the roof preserved. The cave was excavated by the Société Jersiaise in 1910-1911 near the west wall, and by a committee of the British Association in 1914-1915 across the whole width as far as the east wall and for about 50 ft. in a northward direction. Since then Dr. Marett and Père C. Burdo have continued

the excavations under the auspices of the Société Jersiaise, chiefly in the middle and southern parts of the fissure outside the cave, where enormous quantities of "head" have to be removed before the level of occupation can be reached.

The extraordinary coarseness of the debris is largely to blame for the difficulties in identifying and levelling the strata and in correlating the different sections (compare table 2, left column). Near the west wall, hearths were found from 60 O.D. (which height was taken as zero level for the excavation; see note, p. 16) to 65 ft. O.D. The human teeth were found here at 63 ft. The fauna of this section included reindeer, woolly rhinoceros, *Bos*, horse, and an undeterminable small bovid. About 20 ft. of rock debris mixed with loess covered the levels of human occupation.

Near the east wall (table 2, middle column) the section looked different. Beneath rock debris mixed with loess, an upper and a lower complex of implementiferous strata were observed, separated by a thin sterile layer which was sandy-gritty, whitish and hard, and finely stratified. Dunlop suggested an eolian origin for it. The upper complex was made up chiefly of the same loessy rock debris as found higher up, and this material agreed with that of the west wall section. It contained a cold fauna and an industry which Breuil regards as late Levalloisian with Mousterian influence. A rodent bed follows on top, containing banded lemming (*Dicrostonyx*), and in turn is covered by a thin layer with mammoth, woolly rhinoceros, and a Mousterian industry influenced by late Levalloisian.

Underneath the sterile layer, a black-spotted brecciated clay was observed. Rock debris was more frequent near the bottom, where large blocks occurred which had fallen from the roof. The fauna of this lower complex was of a temperate character, and the industry of a type earlier than Levalloisian VI-VII. Breuil, on the evidence of figures only, was inclined to regard it as middle Levalloisian (III-IV) with a late Acheulian (Micoquian) influence. This determination was based on six specimens found closely associated with the molar of an elephant. The specimen had been determined as *Elephas ?trogontherii*, though on re-examination it proved to resemble more closely *Elephas antiquus*.

The lower complex of occupation in the east wall section rested on about 2 ft. of "sterile yellow clay with calcareous concretions." A sample of this material is preserved in the Museum of the Société Jersiaise; it is almost certainly a true loess.

The east wall section thus shows a double change of climate from cold and dry (bottom loess) to temperate (dark clay with middle Levallois) and again to cold (loess and rock debris, with upper Levallois followed by Mousterian). On palaeontological, as well as on typological, grounds this succession cannot be earlier than Riss nor can it be later than Würm. It appears to represent the last phase of the Riss glaciation (bottom loess), the interglacial Riss/Würm (dark clay with temperate fauna) and Würm I (loess with rock debris).

The upward continuation of the section has to be looked for outside the cave, in the middle and southern parts of the fissure. Here a section was, and in parts

still is, exposed which lies on the mainland side facing the ravine (Table 2, right column). It consists largely of ''head,'' i.e. loess, loess-loam and sandy loess mixed with rock debris. This is essentially the same material as observed in the upper parts of both cave sections. There is no reason not to regard them as of the same age everywhere (Würm I), with the exception of some decalcified loess and sandy loess above the head which is possibly later (sample studied from the south fissure, 13 m. above bench-mark). The correlation of the ''head'' outside the cave with the top strata inside the cave is confirmed by the reappearance of the rodent bed with the same lemming fauna. From this bed Père Burdo has obtained most promising material which has not yet been published.

It has been suggested more than once that the deposits of the Cotte de St. Brelade rest on the 60-ft. beach as does the occupation stratum of the Cotte à la Chèvre, but nobody has ever seen it. At 60 ft. above O.D., the excavations stood entirely in terrestrial deposits, and the trial trench dug below the 60-ft. level near the west wall in 1911 revealed no trace of the beach. During my visit to Jersey in 1938 I re-excavated this part of the section and tried to go down as far as possible, in order to study the deposits below the 60-ft. level. The results are outlined in the left column of Table 2.

The uppermost 10-30 cm. are composed of yellow loessy earth mixed with debris of rock. It contains flints and bones, but part of it must be the remnants of earlier excavations. The material itself clearly belongs to the upper complex of loessy clay with fragments of rock.

There follow 30-40 cm. of a peculiar chocolate-coloured humous granitic sand, very light in weight when dry. In places it is of a loamy brown, and well stratified. Fragments of rock are scarce in this layer, but holes forming moulds of branches are frequent, as well as dark humic impressions, some of which resemble grass leaves or pine needles, and seeds of conifers. Several specimens of wood cavities showed the mode of branching characteristic of conifers. Sinel mentions that remains of elm with ivy adhering to it were found in what appears to be this layer. He further mentions ''animal remains'' and ''fossilised bone,'' but I have not encountered any. About 6 ft. away from the west wall cavities formed by roots are abundant, and bear out that at least some of the vegetation grew on the spot. This, in conjunction with the evidence for intense disintegration of the granite, shows that the climate was temperate and fairly humid, and very different from that of the following period, during which coarse debris of rock mixed with eolian dust was deposited. No implements have been found in this horizon.

The chocolate layer rests on about 80 cm. of loosely packed angular blocks, many of which measure 2-3 ft. across. The spaces between the blocks are either entirely empty, or filled with light brown loam or with a clean, yellow, probably eolian, sand. Near the west wall and towards the recess in which Neanderthal man was found, this bed comes almost up to the surface. A patch of yellow sand is conspicuous here, and

a few chips of flint were observed at a depth of 45 cm. It cannot be ruled out, however, that they may have dropped into one of the crevices and are of later date.

Under this layer of coarse blocks are 80 cm. or more of a brown loam. This loam is dark, but not so chocolate-coloured as the upper horizon. It resembles a weathering loam rather than the loessy material with which the head is mixed. Blocks are present and, from the middle of the layer downwards, the excavation had to be confined to a very small area, as two large blocks were encountered which could not be removed. Towards the bottom of the exposure the loam became very wet. This perhaps indicated that the rock-floor was not far down, but no definite evidence could be obtained. A perfectly rounded pebble of fine-grained aplitic granite, measuring about $2\frac{1}{2}$ in. came from the middle portion of this horizon. It is the only piece of evidence which might indicate the neighbourhood of a marine level. Transport by man cannot be ruled out, however, and it must not be overlooked that its level is 54 ft. O.D. whilst at $52\frac{1}{2}$ ft. O.D. (the lowest level so far reached) the brown loam continued, and the large angular blocks of granite, which show no sign of wave action, must reach several feet further down. If a beach deposit exists in the Cotte de St. Brelade, it is likely to be below 50 ft. Whether a beach is present or not, it cannot be assigned to any of the established interglacial levels if found at such an intermediate height and the age of the cave deposits cannot be determined by this kind of evidence.

The cave must, of course, be older than the earliest deposits found in it. These belong to a cold phase preceding the last interglacial. During the latter phase, the granite weathered and the loam and humic sand of the levels below 60 ft. O.D. were formed. Vegetation grew on the spot at least near the west wall. It is highly probable that the ''black-spotted brecciated clay'' of the east wall section, which contained a temperate fauna and middle Levalloisian implements, is approximately of the same age as the brown loam and the chocolate layer of the west wall section. If so, the dip of the interglacial deposits would be the same as that of the cold deposits which rest on them. This angle (15°) in itself is a serious obstacle to the assumption that the deposits of the cave rest on an ordinary raised beach.

Homo neanderthalensis of the Cotte de St. Brelade was at first considered as an early representative of his race. This opinion has since been modified, and on palaeoclimatological evidence he has to be referred to the late group of Neanderthal man, dating from the first phase of the Würmian glaciation.

MARETT, R. R.: The Site, Fauna, and Industry of La Cotte de St. Brelade, Jersey.—*Archaeologia*, **67**, pp. 75-118, pls. 13-14, Oxford, 1916.

HAWKES, J.: *The Archaeology of the Channel Islands. The Bailiwick of Jersey*, 320 pp., 12 pls., Jersey, 1939.

GIBRALTAR

The skull found at Forbes' Quarry in 1848 cannot be dated.

The child's skull excavated by D. Garrod in 1927 at the rock shelter of Devil's

Tower was embedded in blown sand solidified by calcium carbonate. A sequence of strata of hardened sand and loose sand, containing a rich fauna and a Mousterian industry, rested on the 9 m.-beach of the last interglacial. The fauna, studied by Miss Bate, was composed mostly of mammals and birds which still occur in Spain. Some of them, however, would have required well-wooded surroundings at Gibraltar. The presence of the ibex, great auk, and the alpine chough, suggest that the climate, particularly the summer climate, was more temperate than now. It is therefore conceivable that the Devil's Tower deposits belong to a damp phase following the raised beach phase of the last interglacial. It is reasonable to assume that this was the first pluvial phase corresponding to the Würm glaciation. The sea-level must have been low at that time, as pointed out by Miss Garrod, as plenty of sand was exposed to the action of wind.

Garrod, D., and Bate, D. M. A., and others: Excavation of a Mousterian Rock-shelter at Devil's Tower, Gibraltar.—*Journ. R. anthrop. Inst.*, **58**, pp. 33-113, 7 pls., London, 1928.

D. Undatable Remains

Le Moustier

The descriptions available to me of the circumstances under which the skeleton of Le Moustier was excavated by O. Hauser, contain nothing that would help to date it geologically or palaeontologically.

It is possibly of the same age as the numerous other finds of Neanderthal man made in south-west France, i.e. Würm I.

Klaatsch, H., and Hauser, O.: "Homo mousteriensis Hauseri".—*Archiv. Anthropol.*, new ser. **7**, pp. 287-291, pl. 13, Braunschweig, 1909.

Crimea

In 1924, Bonč-Osmolovskij discovered remains of Neanderthal man in the cave called Kiik-Koba, near Simferopol, Crimea. The section was not more than about 1 m. thick and, apart from a few inches of modern deposit on top, entirely of Palaeolithic age.

The lowest horizon (No. 6) contained an industry which, according to Boule, is reminiscent of the lower layers of Le Moustier, of Taubach and of Ehringsdorf, and a temperate fauna with steppe and woodland elements to which, however, is added one specimen of ice-fox.

A thin sterile deposit separated this from the higher archaeological horizon (No. 4) which enclosed an abundant fauna with mammoth and woolly rhinoceros, reindeer and ice-fox, and an industry which the excavator has called final Acheulian. To judge from the published figures, however, the earlier industry appears to have late Clactonian affinities (Bonč-Osmolovskij calls it " stade amorphe"), whilst the upper,

according to figures and description of the preparation of the cores, almost certainly exhibits Levalloisian affinities. The bifaces are mostly made on flakes, and the majority of the coup-de-poing-like specimens are worked on one side only. Thus the industry may be a late Levalloisian or Levalloiso-Mousterian; it need not be, and probably is not, Acheulian.

The most likely interpretation of the section of Kiik-Koba is that a horizon with a cold fauna and a Levalloiso-Mousterian industry, possibly of the age of Würm I, overlies an horizon with a possibly late Clactonian, Tayacian, or early Mousterian industry and a largely temperate fauna.

The position of the skeletons of *Homo neanderthalensis*, however, is not quite clear. Bonč-Osmolovskij states that the inhabitants who deposited the *upper* layer (No. 6) might have disturbed the grave which, in a ditch, was on a level with the lower horizon (No. 6). This would imply that the human bones were of the age of layer 6, but in his chart *Homo neanderthalensis* is quite plainly attributed to the upper cultural horizon (No. 4). Boule, who had information by letter, says that the skeleton was contained in layer 6, but Keith thinks that "the interment was probably made by the people living on the fourth stratum."

The precise age of this interesting find therefore cannot yet be ascertained, at least not with the literature available to me.

Boule, M.: Découvertes paléo-anthropologiques en Crimée.—*Anthrop.*, **35**, pp. 403-404, and **36**, p. 604, Paris, 1925 and 1926.

Bonč-Osmolovskij, G.: Résultats de l'étude du paléolithique de Crimée.—*Trans. 2nd internat. Conf. Assoc. Study Quatern. Period Europe*, **5**, pp. 113-186, 10 pls., Leningrad-Moscow, 1935.

Gromova, V., and Gromov, V.: Über die paläolithische Fauna der Krim in Zusammenhang mit einigen Fragen der quartären Stratigraphie.—*Trudy sowjetsk. sekc. Inqua*, **1**, pp. 52-96, Leningrad, 1937. (Russian with German summary.)

Neanderthal

The classical Neanderthal skeleton, from a cave near Hochdal between Düsseldorf and Elberfeld, cannot be dated. No detailed record of the strata is preserved nor have implements been found.

Schaaffhausen, D.: On the Crania of the Most Ancient Races of Man. With Remarks by G. Busk.—*Nat. Hist. Review*, new ser. **1**, pp. 155-176, pls. 4-5, London, 1861.

Bañolas

The lower jaw found in 1877 in travertine at Bañolas, north-east Spain, is obviously well fossilised and of Pleistocene age, but it cannot be assigned to any particular phase.

Sergi, S.: La Mandibola di Bañolas.—*Rev. Anthrop.*, **22**, p. 3, 1918. (Not seen.)

Obermaier, H.: *Fossil Man in Spain*. 495 pp., New Haven, 1925.

Malta

Two molars which may belong to Neanderthal man were discovered in 1917 by G. Despott in the Ghar Dalam, a vast cave in the south-east corner of Malta. The teeth lay in a red cave-earth which, unfortunately, had been disturbed by Neolithic and later man. Fossil remains of *Hippopotamus pentlandi* and *Elephas sp.* were associated with it. No pre-Neolithic industry has been found so far. Keith interprets this cave-earth as a terrestrial deposit formed after the recession of the sea from the latest raised beach. This would the Tyrrhenian. The teeth therefore could be of the same age as other neanderthalian finds.

Despott, G.: Excavations conducted at Ghar Dalam in the summer of 1917.—*Journ R. anthrop. Inst.*, **48**, pp. 214-221, London, 1918.

——: Excavations at Ghar Dalam, Malta.—*Journ. R. anthrop. Inst.*, **53**, pp. 18-35, pls. 1-4, London, 1923.

Other Remains

Further undatable remains assigned, with more or less justification, to *Homo neanderthalensis* have been found at the following localities: Arcy-sur-Cure (Yonne), Malarnaud (Arìège), Isturitz (Basses-Pyrénées), Gourdan (Haute Garonne), Petit-Puymoyen (Clarente), Bau de l'Aubesier (Vaucluse), Balla near Misholcz (Hungary; ?Magdalenian, ?*Homo sapiens*), Šipka (Moravia), Ochos (Moravia).

A single incisor was found in a rock shelter at Klause, near Neu-Essing, Lower Bavaria, associated with final Acheulian, mammoth and woolly rhinoceros. Abel (Zeitschr. Ethn., **68**, pp. 256-259, 1936) regards the tooth as neanderthaloid.

Note (see p. 11). While reading the proofs, I had a letter from Père Burdo in which he kindly informs me that the height of this level has been checked and found to be 19·57 m. above O. D.

EXPLANATION OF TABLES

Table 1

Synopsis of the datable remains of *Homo neanderthalensis*. In the fourth column the exact relative age in the last interglacial is given on a geological base, whilst for Würm I the archaeological subdivisions according to Obermaier are inserted.

Table 2

The sections of the Cotte de St. Brelade, Jersey, Channel Islands. The West Wall and East Wall sections are from inside the cave. The distance between them (30 ft.) is given on the same scale as the thicknesses of the strata, and the probable angle of dip is indicated. The ravine section is outside the cave and at right angles to the other two. Its distance from the East Wall is not to scale. After Sinel, Marett, various reports in the *Bull. Soc. Jers.*, and the author's observations.

Table 3

Climate and prehistoric industries of the Late Pleistocene. The Levalloisian and Mousterian may be assumed to represent *Homo neanderthalensis*, Aurignacian and later industries *Homo sapiens*.

In the area from central and west Europe through the Mediterranean to Palestine, the Mousterian, Levalloiso-Mousterian and upper Levalloisian lasted till the end of the first phase of the Würm glaciation. The upper Palaeolithic appeared nearly everywhere before the maximum of the second phase of Würm, in many places as early as during the interstadial Würm I/II.

Lower Aurignacian, however, has been found in a climatically datable position only in Palestine, whilst elsewhere deposits identifiable with the interstadial Würm I/II contain developed Aurignacian. It seems, therefore, that Aurignacian man did not spread generally in the area under consideration before the middle of this interstadial. It is noteworthy that in North France, and possibly in parts of middle Italy also, the middle Palaeolithic did not become extinct before the climax of the second phase of Würm, when the upper Palaeolithic had become well established in the remainder of the area. These conditions are best explained by the assumption of an immigration of a new race of man which spread probably from the east and gradually extinguished the earlier population. There is some evidence in France for middle and upper Palaeolithic being contemporary to some extent.

This table summarises a paper read to Section H of the British Association at Cambridge in August 1938.

Based on the studies of Bate, A. C. Blanc, G. A. Blanc, Boule, Breuil, Garrod, Kelley, Zeuner, and others.

TABLE 1

Approximate astronomical age in years	*Climatic Phase*	*Approximate geological age of* Homo neanderthalensis	*Exact relative date (in Würm 1 according to Obermaier)*
	Postglacial		
22,000	Würm III		
	Interstadial WII/WIII		
72,000	Würm II	(*Homo sapiens*)	
	Interstadial WI/WII		
115,000	Würm I	Gibraltar II, Jersey, La Quina, La Ferrassie, Pech de l'Azé, La Chappelle-aux-Saints, Spy, La Naulette, ?Monte Circeo, Mount Carmel *partim*.	Late Mousterian: La Quina (upper level[1]), Pech de l'Azé, Petit-Puymoyen, Spy, Jersey.
			Middle Mousterian: La Ferrassie, La Chappelle, La Quina (base), Sikpa.
			Early Mousterian: ?Le Moustier.
	Interglacial Riss-Würm, or Last Interglacial	Late: ?Monte Circeo Mount Carmel *partim*, ?Galilee, Krapina, Saccopastore, ?Steinheim, Taubach, Ehringsdorf	PW/W1—Taubach, Ehringsdorf
			Pre-Würm (145,000) ?Saccopastore
			RII/PW
187,000	Riss II		
	Interstadial RI/RII	?Steinheim	
230,000	Riss I		
	Interglacial Mindel-Riss, or Great Interglacial		
435,000	Mindel II		
	Interstadial MI/MII	(Mauer, *Homo heidelbergensis*)	
476,000	Mindel I		
	Interglacial Günz-Mindel		
	Günz glaciation		

[1] La Quina, upper level: child's skull and ramus of lower jaw; basal level: skeleton.

TABLE 2

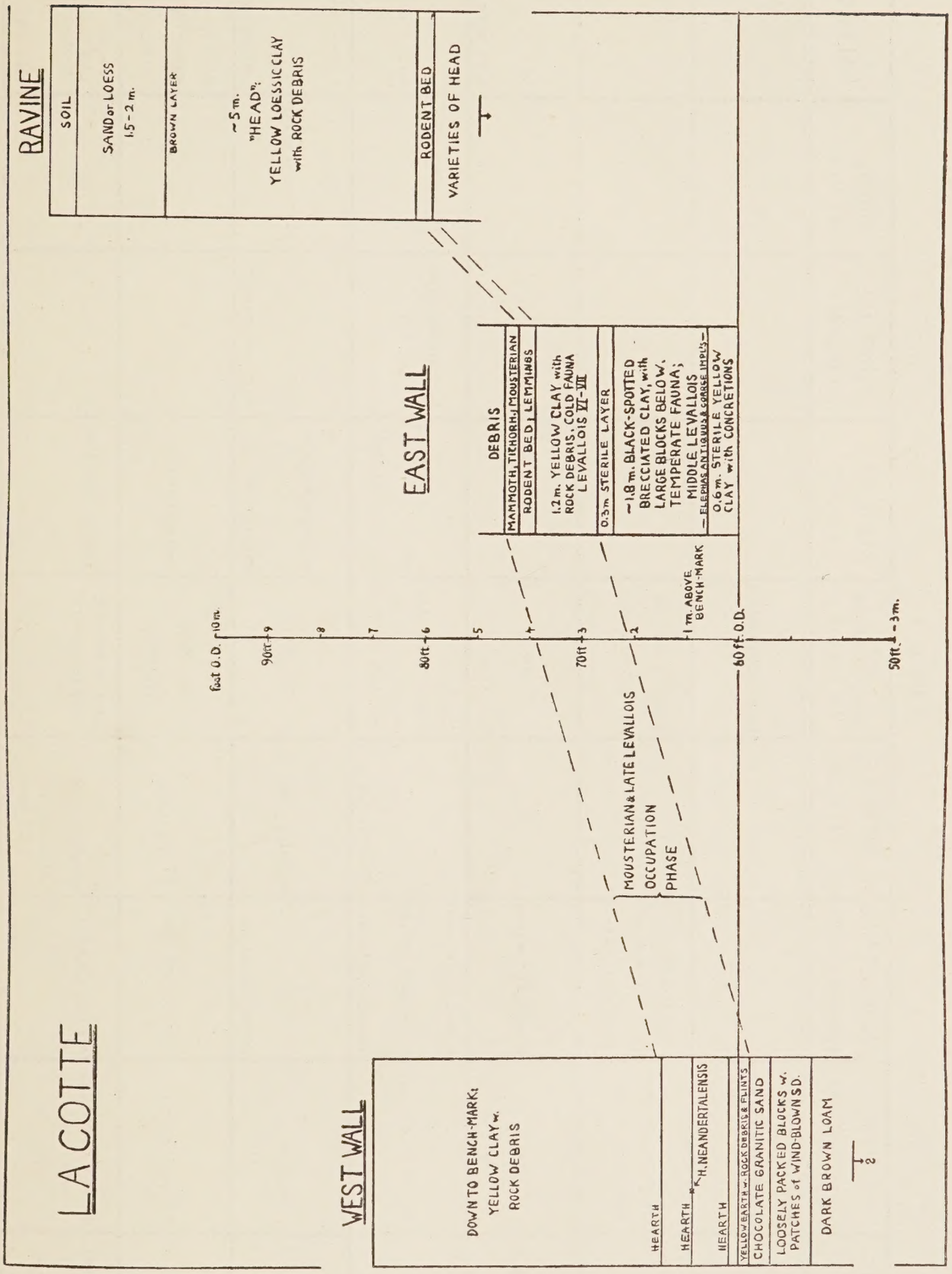
LA COTTE
RAVINE
SOIL
SAND or LOESS
1.5-2 m.
BROWN LAYER
~5 m.
"HEAD":
YELLOW LOESSIC CLAY
with ROCK DEBRIS
RODENT BED
VARIETIES OF HEAD
EAST WALL
DEBRIS
MAMMOTH, TIKHORH.; MOUSTERIAN
RODENT BED; LEMMINGS
1.2 m. YELLOW CLAY with
ROCK DEBRIS, COLD FAUNA
LEVALLOIS VI-VII
0.3m. STERILE LAYER
~1.8 m. BLACK-SPOTTED
BRECCIATED CLAY, with
LARGE BLOCKS BELOW,
TEMPERATE FAUNA;
MIDDLE LEVALLOIS
ELEPHAS ANTIQUUS & COARSE IMPLS
0.6 m. STERILE YELLOW
CLAY with CONCRETIONS
WEST WALL
DOWN TO BENCH-MARK:
YELLOW CLAY w.
ROCK DEBRIS
HEARTH
HEARTH
H. NEANDERTALENSIS
HEARTH
YELLOW EARTH w. ROCK DEBRIS & FLINTS
CHOCOLATE GRANITIC SAND
LOOSELY PACKED BLOCKS w.
PATCHES of WIND-BLOWN S.D.
DARK BROWN LOAM
MOUSTERIAN & LATE LEVALLOIS
OCCUPATION
PHASE
1 m. ABOVE
BENCH-MARK
feet O.D.
90ft
80ft
70ft
60ft O.D.
50ft
10 m.
9
8
7
6
5
4
3
2
1
-3 m.

TABLE 3

CLIMATIC PHASE	CLIMATE C & W EUROPE	INDUSTRIES CENTRAL EUROPE	N. FRANCE (ST. PIERRE)	NORTH MEDITERRANEAN CLIMATE	RIVIERA CAVES	PONTINE MARSHES	SOUTH ITALY	PALESTINE
POSTGLACIAL	TEMPERATE			MEDITERRANEAN				
WÜRM 3	PERIGLACIAL MORE HUMID	MESOLITHIC MAGDALENIAN		COOL & HUMID IN NORTH ONLY				
W2 / W3	COOL	MAGDALENIAN		MILD				ATLITIAN
WÜRM 2	PERIGLACIAL	MAGDALENIAN SOLUTRIAN AURIGNACIAN	FINAL LEV.	COLD & CONTINENTAL COOL & HUMID	EPI-AURIGNACIAN	AURIGNACIAN + ? MOUST.	AURIGNACIAN	MIDDLE AURIGN.
W1 / W2	MILD	? MOUSTERIAN	UPPER PAL.?	MILD	AURIGNACIAN MOUSTERIAN	MOUSTERIAN	AURIGNACIAN	MIDDLE AURIGN. LOWER AURIGN.
WÜRM 1	PERIGLACIAL	MOUSTERIAN	FINAL LEV.	COOL AND HUMID	MOUSTERIAN			UPPER LEVALLOISO-MOUSTERIAN
INTERGLACIAL RISS / WÜRM	HOTTER SUMMERS THAN NOW	MOUSTERIAN	LEVALLOIS V MICOQUIAN LEV. III-IV	SEA WARMER THAN NOW	MOUSTERIAN			LOWER LEVALLOISO-MOUSTERIAN MICOQUIAN

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